Noname manuscript No.
(will be inserted by the editor)

CONTEXT-SENSITIVITY IN JAIN PHILOSOPHY. A DIALOGICAL STUDY OF SIDDHARṢIGAṆI'S *COMMENTARY ON THE HANDBOOK OF LOGIC*.

Nicolas Clerbout, Marie-Hélène Gorisse, Shahid Rahman.

(Preprint Sept. 2010)

Abstract In classical India, Jain philosophers developed a theory of viewpoints (*naya-vāda*) according to which any statement is always performed within and dependent upon a given epistemic perspective or viewpoint. The Jainas furnished this epistemology with an (epistemic) theory of disputation that takes into account the viewpoint in which the main thesis has been stated.
The main aim of our paper is to delve into the Jain notion of viewpoint-contextualisation and to develop the elements of a suitable logical system that should offer a reconstruction of the Jainas' epistemic theory of disputation.
A crucial step of our project is to approach the Jain theory of disputation with the help of a theory of meaning for logical constants based on argumentative practices called *dialogical logic*. Since in the dialogical framework the meaning of the logical constants is given by the norms or rules for their use in a debate, it provides a meaning theory closer to the Jain context-sensitive disputation theory than the main-stream formal model-theoretic semantics.

1 Jain philosophy of logic

In classical India, Jain philosophers developed a theory of viewpoints (*naya-vāda*) according to which any statement is always performed within and dependent upon a given epistemic perspective or viewpoint. The Jainas furnished this epistemology with an (epistemic) theory of disputation that takes into account the viewpoint in which the main thesis has been stated. In nowadays terms, it would be quite natural to understand such a theory from a modal perspective. But the conceptions of Jain philosophers do not seem to meet modern standard (and normal) modal logic. The main reason is that viewpoint bounded epistemic operators are not part of the object language. Indeed, in the Jain framework embedding of epistemic operators, that allows travelling between viewpoints, is not possible. More precisely, viewpoint-knowledge is an implicit epistemic context that bounds the assertion of statements, not an operator that extends the set of logical constants. Moreover, each viewpoint represents a type of epistemic access to objects of the domain of discourse. This (epistemic) type defines a precise frame of the way assertions involving descriptions of those objects are to be justified. The descriptions are determined by the corresponding epistemic type. That

UMR 8163 (CNRS) "Savoirs, Textes, Langages".
University Lille 3.
nicolasclerbout@wanadoo.fr; mhgorisse@gmail.com; shahid.rahman@univ-lille3.fr

is why the Jain contextual theory has been seen as a logic of assertion[1]. E.g., if we are in a viewpoint that denies the existence of universals, sentences such as *There is a property ...* are unassertable. Having said that, it is the case that the internal logic of some viewpoints seems to require a temporal framework.

In section two we develop a formal reconstruction where the epistemic contribution of each viewpoint amounts to the acceptance of specific norms for the use of singular terms, quantifiers, identity statements, and assertions. It is important to point out that in the context of the Indian theories of knowledge each type of knowledge has an own sort of predicates that apply to the correspondent object of knowledge. For the sake of simplicity, in this our first formal exploration we will not implement a many-sorted predication. Such a further development is technically possible for example using devices such as the ones used in DRT or categorial grammar, but we will leave this for a future paper. However, we will explain how we can provide abstract means for this idea in our dialogical reconstruction. The idea behind this is that during a debate that takes place in a fixed viewpoint the Opponent settles the predicates to be used in assertions.

The main aim of our paper is to delve into the Jain notion of viewpoint-contextualisation and to develop the elements of a suitable logical system that should offer a reconstruction of the Jainas' epistemic theory of disputation. This approach should prepare the ground for a further development of a frame where the debate between the different viewpoints could be unified into one general logical system of argumentation. A crucial step of our project is to approach the Jain theory of disputation with the help of a theory of meaning for logical constants based on argumentative practices called *dialogical logic*. Since in the dialogical framework the meaning of the logical constants is given by the norms or rules for their use in a debate, it provides a meaning theory closer to the Jain context-sensitive disputation theory than the main-stream formal model-theoretic semantics. Accordingly, when we speak of, say, second-order quantifiers we do not assume a model-theoretical semantics with its underlying set-theory.

We hope that such a reconstruction provides to the modern reader both an insight into the logical issues at stake in the Jain philosophy and some new perspectives in philosophy of logic, particularly in the almost lost ancient relation between logic and argumentation that experiences nowadays a fascinating revival.

The paper is structured in three main sections:
In the following section we present the Jain theory of viewpoints from an epistemological perspective.
In the second section we present our dialogical reconstruction of the Jain theory of disputes.
The third section outlines briefly our next research project, namely the development of a unified theory of the (dia)logic of disputes where one viewpoint is confronted to another.

1.1 The Jain theory of viewpoints (*naya-vāda*)

Our paper is restricted to the study of Siddharṣigaṇi's tenth century *Commentary on the Handbook of Logic* (*Nyāya-avatāra-vivṛti*, NAv). The work of Siddharṣigaṇi constitutes the first commentary to Siddhasena Divākara's seven century *Handbook of*

[1] See for example Ganeri's presentation in [4], especially pp. 354-356.

Logic (*Nyāya-avatāra*, NA)[2]. We chose to work on this period because the lively debates between different rival schools that took place at that time triggered a development of the early Jain theory into a comprehensive system. Furthermore, we selected this text because:

- NAv is a comprehensive work that discusses and systematizes not only most of the previous gnoseological Jain theories, but also the other Indian schools of thought of the time.
- NAv had an important influence. Indeed his commentary is widely quoted and discussed in other Jain treatises such as Malliṣena's *The flower-spray of the Quodammodo doctrine* (*Syād-vāda-mañjarī*, SvM) and Hemacandra's *A Critique of Organ of Knowledge* (*Pramāṇa-mīmāṃsā*, PMī)[3].

Jain philosophers consider that the object of knowledge is multiple (possibly characterized by infinity of aspects) and that when we know we are often focusing on only one given viewpoint[4]:

> An object qualified by one facet is known as the province of the viewpoint[5].

According to NAv the way the knowing agent is intending to apprehend the subject of a predication while uttering an assertion is what distinguishes epistemically one viewpoint from another. By nature, a viewpoint-bounded assertion of the kind mentioned above provides an incomplete description of a given object and complete knowledge about something is the sum of all the incomplete descriptions[6].

Siddharṣigaṇi, as other Jain philosophers of this period, proposes a seven-fold classification of the different viewpoints[7].

> Ancient preceptors taught that there are seven viewpoints, by means of assuming seven outlooks that collect together all [possible viewpoints], namely 'there are the [following] viewpoints: comprehensive, collective, empirical, direct, verbal, etymological and factual'. Therefore, also we have described them exactly [in the same way][8].

As will see below Siddharṣigaṇi links each viewpoint with a particular philosophy. In fact the Jain theory of knowledge is an epistemological framework the aim of which is to include all the main theories of knowledge (in that period of time) Indian philosophy.

In the following section we discuss each of the seven viewpoints presented in the NAv. Let us stress the fact that each viewpoint summarizes a *type* of knowledge represented by different sophisticated schools of thought. Hence the picture of the Indian

[2] We here follow the dating of Piotr Balcerowicz: after 620 CA because this work is a post-Diṅnāga as well as post-Dharmakīrti work, and before 800 because it is a pre-Haribhadrasūri work. For details, see [12] pp. iii-xli.

[3] The later 'could even hardly be conceived without Siddharṣigaṇi's [commentary]', ibid.

[4] All the translations of NAv presented in our paper are quotes of Balcerowicz' own translation and edition. As for translations of other texts, the name of the translator will be duly indicated.

[5] NA 29, [12] p. 83 (English translation) and p. 425 (edition): *eka-deśa-viśiṣṭo'rtho nayasya viṣayo mataḥ*.

[6] The possibility of human omniscientxd people is not rejected by Jain philosophy, in which ideal knowledge is considered to be the soteriological project of an individual.

[7] Still, there is room to say that the text intended a five-fold classification, according to which the first four viewpoints, to put it in our author's own words, are *adroit at describing the intrinsic nature of the objects* (*artha-svarūpa-nirūpaṇa-nipuṇānāṃ*) and the other three *are apt to examine speech elements* (*śabda-vicāra-caturāṇām*), NAv 29.18. Such a five-fold classification is sensible. Now, by the same argument, we could conclude that there are only two main viewpoints, namely the object-bounded and the speech-bounded. However, we made the choice to follow his explicit classification of seven viewpoints.

[8] NAv 29.12, [12] p. 97 and p. 440: *cirantanācāryaiḥ sarva-saṅgrāhi-saptābhiprāya-parikalpanādvāreṇa sapta nayāḥ pratipāditāḥ. tad yathā 'naigama-saṅgraha-vyavahāra-ṛjusūtra-śabda-samabhirūḍhaivambhūtā nayā' iti. ato'smābhir api ta eva varṇyante.*

schools of thought offered by the viewpoints is designed in quite broad lines. In fact, this is part of the strategy of Siddharṣigaṇi who did not aim at an exegetical study of the other schools but classify different types of knowledge. Furthermore and more generally, according to the Jainas, every school of thought discussed is in some sense defective, since they do not acknowledge that their own perspective is only one possible viewpoint among others.

1.1.1 The universal-particular viewpoint (naigama-naya)

The Sanskrit expression *naigama* (a *verbatim* translation would be *related to sacred texts*) has been used in a technical sense by the Jainas to denote their first viewpoint. This Sanskrit expression has been exegetically explained in several different ways by the Jainas and scholars hardly agree on its translation (comprehensive, figurative, teleological, non-distinguished, analytical, etc.). Because of this difficulty, we renounce to give a translation of *naigama* and thus call this viewpoint *the universal-particular viewpoint*, following Padmarajiah[9] and the already mentioned commentary of Balcerowicz to his own translation of Siddharṣigaṇi's text.

Indeed, this viewpoint stresses the fact that there is no unique way of epistemic knowledge: there is the knowledge of the universal and the knowledge of the particular:

> [Second meaning] Or '*naigama*' [means] 'that which goes in a non unique way', because it grasps the characterizing locatee (*dharma*) and the characterized *locus* (*dharmin*)[10] as what is either main, either secondary (*guṇa*)[11].

The Nyāya-Vaiśeṣika is the main Indian school of thought that is considered to characterize this viewpoint. According to this school we experience knowledge, but knowledge implies the ability to classify things by the recognition of the existence of common features or universals (*sāmānya, jāti*). From this gnoseological experience the philosophers of the Nyāya-Vaiśeṣika school draw the conclusion that universals exist. Furthermore since we have not only the experience of a plurality of particularizing gnoseological processes but also the experience that the latter are different from the first (the experience of universal knowledge) this school concludes that there exist particulars and that they are different from universals.

The main assumption is that each type of gnoseological process has an object of knowledge of its own. Now, since we are able to distinguish the gnoseological process by the means of which we come to know about this particular object, say a cow, from the process by the means of which we apprehend the concept of, say, *cowness*, we are also able to distinguish the objects of knowledge involved in those gnoseological processes, namely: the particular object, cow, and the universal object, *cowness*[12].

---

[9] Cf. [13] p. 314 ff.

[10] There are controversies about the translation of these two terms. *Dharma* cannot be properly translated as *property* because a *dharma* might be a quality, a property or an abstract universal, as well as a concrete substance. Hence, the proposal accepted by most scholars to translate them as *locatee* and *locus*, following Matilal's proposal to see the Indian model of logic as dealing with localisation: *the Sanskrit logicians tried to explain the structure of the 'atomic' qualificative knowledge with a model that I have called the 'property-location' model*, [11] pp. 26-27.

[11] PKM, [14] p. 677: *nigamo hi saṅkalpaḥ, tatra bhavas-tat-prayojano vā naigamaḥ [...] yad-vā na-ekaṅ-gāmo naigamo dharma-dharmiṇor-guṇa-pradhāna-bhāvena viṣayī-karaṇāt.* The translation is from one of the authors.

[12] NAv 29.14, [12] p. 98 and p. 443: *evaṃ ca pramāṇayati: paraspara-viśliṣṭau sāmānya-viśeṣau, pārthakyenopalabdher, iha yad yat pārthakyenopalabhyate tat tat paraspara-viśliṣṭaṃ dravyaṃ, tad yathā devadatta-yajñadattāv iti, pārthakyena copalabhyete sāmānyaviśeṣāv, ataḥ paraspara-vibhinnāv iti.*

> And [the followers of the Nyāya-Vaiśeṣika school] adduces the following proof[13]:
> **Thesis.** The universal and the particular are disjoined from each other.
> **Reason.** Because they are comprehended separately.
> **Inference.** In this world, whatever substances are comprehended separately, they are disjoined from each other; for instance [the process by which we grasp the proper names] Devadatta and Yajñadatta [involves the knowledge of two disjoined individuals].
> **Application.** And indeed the universal and the particular are comprehended separately.
> **Conclusion.** Hence they are disjoined from each other.

In fact, Siddharṣigaṇi speaks about *ni-gama* coming from **ni***ścita*-**gama***naṃ* (determined comprehension) in the sense of *being able to grasp a multiple object*[14]. In our dialogical reconstruction of section two we draw the following consequences of Siddharṣigaṇi's talk of a *multiple object*: while asserting some predication about a given particular the utterer is also committed to the existence of the correspondent property involved in that predication. Furthermore, in the logical context, it is important to notice that in a number of Indian teachings universals are always linked through *inherence* (*samavāya*) to a particular and that a universal is not contained in another universal[15]. Thus, though universals are disjoint elements of the domain of discourse, and it is possible to quantify over them, the assertions in which they are embedded always involves the predication of particulars. Thus, assertions always involve a multiplicity, namely the universal and a correspondent particular. The upshot of this is second-order quantification, not a higher-order one. The logic underlying the first viewpoint combines then, second-order with first-order quantifiers (see section two).

According to our text NAv 29.14 the first viewpoint includes the second (*highest and intermediate universals*), third (*intermediate particulars*) and fourth viewpoint (*ultimate particulars*):

> Indeed, this [viewpoint] intends:
> – **The highest universal** consisting in existence and
> – **[Lower] intermediate universals** viz. substantiality, qualitativeness and the state of being of an object of an action, furthermore, [it intends]
> – **Ultimate particulars,** consisting in [specific] forms not common to all, as well as
> – **Intermediate particulars,** capable of being distinguished [from particulars that have] other form by [the cognition of] recurrent continuity, because [these particulars] are in their intrinsic nature absolutely detached from the universal[16].

In our reconstruction the language must take two kinds of objects into account: particulars and universals. Moreover, it must give an account for the inherence relation that may hold between some universals and some particulars. The formal counterparts of these conditions are: first-order predicates, individual constants, first-order predication and quantification. Now the fact that there is no possible inherence between

[13] The Sanskrit expression *sādhana* or *pañcāvayava-vākya* is usually translated as *syllogism*, but we are here following the suggestion of Piotr Balcerowicz in **[**12**]** p. xl to translate it as *proof* in order not to confuse this form of argumentation with the Aristotelian one.

[14] NAv 29.12.

[15] Many thanks to an anonymous reviewer that draw our attention to this fact of Indian Logic.

[16] NAv 29.14, **[**12**]** p. 98 and p. 442: *ayaṃ hi sattā-lakṣaṇaṃ mahā-sāmānyam avāntara-sāmānyāni ca dravyatva-guṇatva-karmatvādīni tathāntyān viśeṣān sakalāsādhāraṇa-rūpa-lakṣaṇān avāntara-viśeṣāṃś cāpekṣayā para-rūpa-vyāvartana-kṣamān sāmānyād atyanta-vinirluṭhita-svarūpān abhipraiti.* We thereby thank one of the reviewers of this paper, who stressed the fact that *antya-viśeṣa* (used by Siddharṣigaṇi in the sense *ultimate particular*) is a technical expression from the Vaiśeṣika school, in which it designates *the extreme counterpart of highest universals in a scale of increasing and decreasing generality.*

universals is captured by the idea that there is no predication of predicates. But we must be able to express that there are such things as universals in our domain. Thus we need quantification on predicates, i.e. second-order quantification, but not higher-order one.

1.1.2 The summarizing viewpoint (saṃgraha-naya)

The idea behind the summarizing viewpoint[17] is that the perceptible world is the world of changes but, according to this gnoseological perspective, change is not knowable. Knowledge is about what is permanent. Hence, the goal of knowledge is to grasp the unity between two apparently different particular objects by realizing that they are mere manifestations of the same universal. For example, different particular pots are but instances of the universal *potness*. NAv 29.15 presents this point in the following way:

> The collective [viewpoint] is that which collects together, i.e. it takes the world as consisting in the universal, by means of completely ruling out the particular[18].

The Indian schools considered by the Jainas as representing this viewpoint are the Monist schools, especially the Advaita-vedānta and the Sāṃkhya. According to them,

> (What is illusionary known as) the particulars are (in fact) the Being alone because they are not different from this Being[19].

> For example, when we say *pot*, all the manifestations of the pot merge into a unity, due to their *potness*[20].

The logic underlying this viewpoint consists of the following elements (see section three):

1) Universals: second-order quantifiers.

2) No quantification over particulars, no universals contained in other universals: neither first-order nor higher-order quantifiers.

3) Particulars are nothing but manifestations of universals: *summarizing rule*.

Let us explain roughly the idea behind the idea of what we call the *summarizing rule*. According to this viewpoint, sentences such as *This object is a pot and that object on the table is a pot*, allows us to disregard the particularity that differentiate both objects and consider them nothing but manifestations of the universal *potness*. The point is that in relation to the predicate that expresses the universal the bearer of the expression *this object* is undistinguishable from the bearer of the expression *that object*. This could be expressed by a rule that allows to assert the equality of two terms (*this*

[17] Notice that with the expression *summarizing*, we translate literally the Sanskrit expression *saṃgraha*, that conveys the idea of bringing together several distinct elements. We thank an anonymous reviewer for suggesting this translation that follows the one of Frauwallner in his *History of Indian Philosophy*, vol. I-II. Translated from the original German by V. M. Bedekar. Delhi: Motilal Banarsidas, (1953) 1997.

[18] NAv 29.15, [12] p. 99 and p. 443: *saṅgṛhṇāty aśeṣa-viśeṣa-tirodhāna-dvāreṇa sāmānya-rūpatayā jagad ādatta iti saṅgrahaḥ*. The PKM is even more clear concerning this idea of collecting together in the sense of focusing on similarities in [14] p.677: *[It is called] the summarizing [viewpoint] because, having presented things whose difference has been ruled out, it collects them together in a unity that is not against their genus (jāti)* (*sva-jāty-avirodhena-ekadhyam-upanīya-arthān-ākrānta-bhedān samasta-grahaṇāt-saṃgrahaḥ*).

[19] NAv 29.15, [12] p. 99 and p. 444: *bhāva-mātraṃ viśeṣās, tad-avyatiriktatvād*. We could draw a parallel with this conception and the philosophy of Parmenides in Ancient Greece.

[20] PKM, [14] p. 877: *tathā 'ghaṭaḥ' ity-ukte nikhila-ghaṭa-vyaktīnāṃ ghaṭatvena-ekatva-saṃgrahaḥ*. The translation is from of one of the authors.

object, *that object*) in relation to a predicate (to be a pot) if they share this very same predicate. This rule can be expressed more adequately in a formal framework that goes beyond standard semantics for first-order logic, and where the summarizing process is formulated only at the ontological level (as explained in our discussion of the fourth viewpoint).

1.1.3 The viewpoint of worldly transactions (vyavahāra-naya)

In this viewpoint, only that which has impact on human actions is knowable:

> The empirical [viewpoint is explained] as practical use, or as such the outlook with which [something] is used practically by common people[21].

According to this viewpoint, that represents the type of theory of knowledge of schools such as the one of the Cārvākas, the intermediate particulars and not the universals can be subject of knowledge. Very briefly, the argument runs as follow: if the highest universal would be knowable, then it would be possible to know everything. However, we never experience such a cognitive ability[22].

A similar counterargument is developed against the knowability of intermediate universals, since their knowledge would commit us to the knowledge of every instantiation of such universals. Our text provides also an argument against the fourth viewpoint that links knowability, persistence and daily practice. Knowledge is about what is of use in daily life, but, as we will discuss below, the ultimate particulars of the fourth viewpoint, the infinitesimal atoms, are not persistent (each atomic infinitesimal is specific to a particular moment) and are thus of no use in daily life. Hence, ultimate particulars, cannot be the subject of knowledge[23].

In principle, the basic underlying logic assumes no other logical devices than the ones provided by first-order quantification. We say in *principle*, since we do not delve here into the inner structure of intermediate particulars. In fact, the underlying logic of the fourth viewpoint requires a sophisticated formal frame where this (third) viewpoint could be seen as a special case in which objects of knowledge are not atomized into ultimate elements.

1.1.4 The viewpoint of ultimate particulars (ṛju-sūtra-naya)

In this viewpoint[24], only infinitesimal atoms (*paramāṇu*) can be known. These infinitesimal atoms are ultimate particulars in the sense that they constitute the ultimate units

[21] NAv.29.16, **[**12**]** p. 100 and p. 445: *vyavaharaṇaṃ vyavahriyate vānena laukikair abhiprāyeṇeti vyavahāraḥ*

[22] Ibid.: *The universal with no beginning nor end, [numerically] one, considered by the collective [viewpoint], [does] not [constitute] the scope of a cognitive criterion because there is no such experience* (*na sāmānyam anādi-nidhanam ekaṃ saṅgrāhābhimataṃ pramāṇa-bhūmis, tathānubhavābhāvāt.*).

[23] Ibid.: *The particulars characterized by infinitesimal atoms [that] perish in a moment can never effect people's everyday life practice, so these do not constitute the real thing, because only [entities that are] conducive to people's everyday practice are real things* (*kṣaṇa-kṣayi-paramāṇu-lakṣaṇā viśeṣā na kañcana loka-vyavahāram uparacayanti, tan na te vastu-rūpā, loka-vyavahāropayogināṃ eva vastutvād.*).

[24] The *verbatim* Sanskrit expression *ṛju-sūtra-naya* has been often translated as *the straight viewpoint*. The problem is that it is not that easy to make this translation compatible with Siddharṣigaṇi's own understanding of the fourth viewpoint. Thus, we chose here too not to give a translation of *ṛju-sūtra* but to characterize this viewpoint as the one where its object of knowledge are ultimate particulars.

in the process of decomposition of what exists. These infinitesimal atoms occur only here and now. They are not persistent. Knowledge of the existence of a persistent particular pot is but an illusion due to the presence of an infinitesimal atom here and now. Knowing the past or the future is impossible because, according to this viewpoint, empirical induction is not granted. Knowledge experiences have a scope of efficiency restricted to the here and now. More precisely, through the knowledge of an infinitesimal atom at a given time-place location t_1 and the successive knowledge of an infinitesimal atom at another time-place location t_2, I cannot infer the identity of both and, from this, the existence of a persistent object from t_1 to t_2:

> The direct [viewpoint is explained as follow]: [it] draws out, [i.e.] plainly demonstrates - directly, [i.e.] in a straight manner, [or] not crookedly, [i.e.] by evading past and future bends [of the real thing] - the form of the real thing, whose transient occurrence [falls to] the present moment[25].

According to our author, the school of the Tathāgata is a representative of this viewpoint.

The underlying logic of this viewpoint requires a far more sophisticated formal instrument than the one of the other viewpoints. Our, exploratory, proposal is to abandon the standard first-order and second-order frame in favour of a temporally structured semantics. In other words, semantics that takes into account scenarios. Such scenarios could be thought of as time points (moments) or time-place points (more generally, they could be conceived as states of information (of different agents), facts, etc.). However this is not enough, since the logic of this viewpoint requires a notion of individual that is both compatible with the idea that the object of knowledge is at the very end an ultimate particular and adequate for the underlying time-place points semantics. According to our understanding, Hintikka's notion of a world-line satisfies the conditions mentioned above[26]. Indeed, in such a theory an individual is understood as a (partial) function that might pick up one object from the domain of a given scenario t, called the aspect of the individual at t (of this aspect, one can assert at t, for example, that it satisfies the predicate A) and an object from the domain of a different scenario t' (of this other aspect, one can assert at t', for example, that it satisfies the predicate B and not the predicate A). Clearly, we propose to call the objects of the domain of a scenario ultimate particulars (and not aspects). No object of the domain of a scenario can be compared with another object of a different scenario. A singular term, such as constant k, will refer in different t-scenarios (moments, time-place points), to different ultimate particulars. In such a frame, it could well be the case that we have knowledge that enables us to recognize that a constant k has a bearer at scenario t, and that this bearer might be a ultimate particular of an individual in some other scenario t', but we might fail to know which is the corresponding individual and the specific scenario t' at stake. Moreover, it is not granted that we have the knowledge that the constant k of different scenarios is an aspect (ultimate particular), of the same individual. If this knowledge is available we might see the k at, say, t and t', as ultimate particulars that constitute the individual, call it, g. We represent this case as the drawing of a line that links two objects of different scenarios. Once more, knowledge is about the

[25] NAv 29.17, [12] p. 101 and p. 446: *ṛju praguṇam akuṭilam atītānāgata-vakra-parityāgād vartamāna-kṣaṇa-vivarti-vastuno rūpaṃ sūtrayati niṣṭaṅkitaṃ darśayatīti ṛjusūtraḥ*. There is a typical device in Sanskrit commentary texts that consists in annotating the technical terms by more common terms. For example here, *praguṇam* (in a straight manner), is added to *ṛju* (directly); and *sūtrayati* (draws out) is explained by the following second term which has a similar meaning *niṣṭaṅkitaṃ darśayati* (plainly demonstrates, in Balcerowicz' terms), hence the feeling of repetition.

[26] Cf. [6].

ultimate particulars and assertions (and the involved predications) are grounded on them. According to this viewpoint the third viewpoint makes the mistaken assumptions that individuals (functions) and not ultimate particulars (element of the t-scenarios) are the objects of knowledge, and that the knowledge required to link ultimate particulars is always granted. In such a framework, the *summarizing rule* of the second viewpoint can be formulated in a purely ontological manner in the following way: If two objects of the domain of two different scenarios share the same property, then a world-line can be drawn. Hence each world-line will be property-bound[27]. Hintikka's semantics is model-theoretical, however we will embed this semantics in a dialogical framework, where different sorts of individual terms are defined.

Notice that, as pointed out before, we do not preclude that this (and the other viewpoints) has an own sort of predicates that apply to their object of knowledge.

1.1.5 The viewpoint of synonymy (śabda-naya)

Siddharṣigaṇi calls this viewpoint the *speech-bound* (*śabda-naya*) viewpoint. Unfortunately, he also points out that the following two are *speech-bound*. This might raise the suspicion that, after all, there are not seven but only five viewpoints, and that the latter is sub-classified in three[28]. As mentioned above, we made the choice to follow the author's explicit seven-fold classification and we will continue to stick to this decision here. However, for reasons that will be clear further on we will call the fifth viewpoint *the viewpoint of synonymy* - though we do not claim that it is a translation of *śabda-naya*[29].

The main philosophical tenet of all the three speech-bound viewpoints, is not only that every word denotes an object, but that language and object are linked by a relation that makes them inseparable[30], or at least that there is no other epistemic access to an object than by the means of language[31]. Indeed, according to NAv 29.18:

> **Thesis.** Object is not, [by any means,] different from word[32].
> **Reason.** Because that [object] is known when that [word] is known.
> **Inference.** In this world, if x is known when y is known, then x turns out to be not different from y; for instance: the intrinsic nature of that very [word] when the word is known.
> **Application.** And [indeed] object is known when word is known.

[27] More generally, in such a framework, the other two viewpoints can be seen in the following way: The first viewpoint is the case where there is only one scenario with two kinds of individuals, namely universals and (intermediate) particulars. Universals have as values bunches of objects of a domain (bunches can be thought of as classes but not necessarily so). Individuals will then be conceived as a kind of relations and not functions. Particular-individuals take as values an object of the domain that constitutes one of the bunches that define a universal. In other words, particulars will always be part of a universal, even in the special case that we do not know to which. Second-order quantifiers take universal-individuals as values, and first-order quantifiers take particular-individuals as values. Singular constants are interpreted as the values of particular-individuals.
The second viewpoint is the case where there is (possibly) more than one scenario, with only one kind of individuals, namely universals, defined as before and over which second-order quantification range.

[28] In fact, one anonymous reviewer contested the seven-fold presentation.

[29] By the way, this choice has also been taken by Padmarajiah in [13] p. 320 ff.

[30] Nowadays we would call this an *internal* relation.

[31] On our view, this suggests that model-theoretic semantics is not a suitable approach to the theory of meaning underlying the speech-bound viewpoints.

[32] The Sanskrit term is *śabda*. Balcerowicz chooses, and rightly so, the translation *speech element*. However, for the sake of stressing the point of the argument, we opted for the translation *word*, which perfectly matches the use of this term in this precise context. For the same reasons, we substituted Balcerowicz's translation of *pratīta* (cognised) with the participle *known*.

Conclusion. Hence that [object] is not different from this [word][33].

Interesting is the fact, that our author does not specify any specific Indian school of thought that represent the speech-bound viewpoints.
The main claim of the fifth viewpoint is that the epistemic access to identity amounts to synonymy, and more precisely synonymy in Sanskrit. Accordingly, if two different Sanskrit words are falsely thought to have the same meaning, then two different objects might be wrongly taken as being the same. In fact, *synonymy* is grounded on the proper knowledge of the usage of the language. Therefore, knowledge of Sanskrit is intrinsically linked to a sound knowledge of the world. This applies particularly to proper names that, according to the speech-bound viewpoints, have always a specific meaning behind. Actually, recognition of identities by means of mastering the knowledge of *synonymy* is the main way to knowledge described by the fifth viewpoint:

> The verbal[34] [viewpoint] intends, as they say, by the force of understanding, one object for all such linguistic units, like *Indra*, *Śakra* and *Purandara*, etc., that are used - in accordance with the usage - to denote a specific object[35].

The underlying logic requires devices such as definite descriptions, formulated as terms and that convey the meaning of proper names. The framework must also assume that some definite descriptions convey meanings established as synonymous by a given linguistic community. Furthermore, the standard substitution rule for singular terms must be grounded on the synonymy of definite descriptions. This device must also be extended to indefinite descriptions.

1.1.6 The viewpoint of semantic analysis (samabhirūḍha-naya)

The Sanskrit term for this viewpoint is *samabhirūḍha-naya*. This term has been translated as *etymological* (Balcerowicz, Padmarajiah)[36], *subtle* (Bhattacharya, Vidhyabhusana)[37] and *specific* (Goshal, Tatia)[38]. We made the choice to call it *semantic analysis*.

The main claim of this viewpoint is that a proper and accurate understanding of the meaning (or descriptive content) conveyed by a given speech unit leads to a unique and fixed epistemic access to a particular object, that does not go over to another object. For short, the descriptive content of a linguistic expression characterizes a unique object.

---

[33] NAv 29.18, [12] p. 104 and p. 449: *pramāṇād iti brūmaḥ. tathā hi: na vyatirikto'rthaḥ śabdāt, tat-pratītau tasya pratīyamānatvād, iha yat-pratītau yat pratīyate tat tato'vyatiriktaṃ bhavati, tad yathā śabde pratīyamāne tasyaiva svarūpaṃ, pratīyate ca śabde pratīyamāne'rtha, 'to'sau tato'vyatirikta iti..*

[34] Balcerowicz, whose translation we follow here, calls the fifth viewpoint *verbal*.

[35] Ibid.: *śabdo: rūḍhito yāvanto dhvanayaḥ kasmiṃścid arthe pravartante; yathendra-śakra-purandarādayaḥ, teṣāṃ sarveṣām apy ekam artham abhipraiti kila pratītivaśād.* As already mentioned, we follow mainly Balcerowicz' translation. Another possibile translation suggested by an anonymous reviewer is the following: *As it is reported (kila) the word [in so far as it is] employed in its conventional meaning aims with the help of a complete understanding (pratītivaśād) at one and the same object for all those expressions which refer to some object, such as Indra, Śakra, Purandara, etc.*

[36] P. Balcerowicz in [12] p. 105 ff. and Y. J. Padmarajiah in [13] p. 321 ff.

[37] H. S. Bhattacharya in his edition of the *Pramāṇa-naya-tattvālokālaṅkāraḥ* of Vādi Devasūri, Jain Sahitya Vikas Mandal, Bombay, 1967, p. 530 ff. And S. C. Vidhabhusana in his *History of the Mediaeval School of Indian Logic*, Calcutta University, 1907, e.g. p. 12.

[38] S. C. Goshal in his edition and translation of the *Parīkṣāmukham* in *The sacred books of the Jainas* vol. 11, Today and Tomorrow's printers and publishers, Delhi, 1990, p. 202. And N. Tatia in his edition and translation of the *Tattvārtha Sūtra* of Umāsvāti, Lanham, MD: Rowman Altamira, 1994.

According to this viewpoint, there is a one-to-one correspondence between descriptions and their objects[39]. In other words, whereas in the fifth viewpoint, the three names *Indra*, *Śakra* and *Purandara* stand for the same object of knowledge, namely *the king of gods*, each denotes a distinct object of knowledge in the sixth viewpoint, namely *[the one who possess] divine supremacy*, *[the one who has the] ownership of might* and *[the one who posses the] ability to destroy the strongholds*. Accordingly, the sixth viewpoint denies synonymy NAv 29.20:

> Similarly, Śakra ('possessed of might') [is called as such] because of might; Purandara ('destroyer of strongholds') [is called as such] because of destroying of strongholds - by these and other [examples] one [can] demonstrate that all speech elements have different objects (*denotata*).[...]
> So, there are no linguistic units which denote one [and the same external] object (denotatum)[40].

The underlying logic of this viewpoint should be grounded in a formulation of definite (and indefinite) descriptions that disallows substitution *salva veritate*.

1.1.7 The such-like viewpoint (evaṃbhūta-naya)

The Sanskrit term for this viewpoint is *evaṃbhūta-naya*. This term has been translated as *factual* (Balcerowicz)[41], *such-like* (Bhattacharya, Padmarajiah, Vidhyabhusana)[42] and *active* (Goshal, Tatia)[43]. We made the choice to follow the translation of Bhattacharya, Padmarajiah, and Vidhyabhusana.

This viewpoint shares the one name/description-one object approach of the sixth viewpoint discussed above. In fact, it might be argued that it is not a viewpoint of its own but a further precise development of the sixth viewpoint. Indeed, this viewpoint parameterizes the descriptions mentioned in the viewpoint of semantic analysis to a given time-place reference point. For short, the descriptive content of a linguistic expression characterizes a unique object of the *present*. Thus, an object can be called with a given name, (e.g. *Indra*) if and only if that object satisfies *now and here* the property conveyed by the meaning of the name (in our case, *[the one who posses] divine supremacy*). Another way to see the relation with the sixth viewpoint is a change of the word-object perspective: whereas the viewpoint of semantic analysis focuses on how the meaning conveyed by names lead to the knowledge of an object, the such-like viewpoint focuses on the conditions an object has to satisfy in order to be called/described as such by a given linguistic expression. In our author's own words (translated by Balcerowicz):

> Therefore, only in such a moment, when there exists the factor [accountable for] the grammatical formation [of the speech element 'x'] in a full-fledged form, the object

[39] We thank an anonymous reviewer for this formulation that, despite his scepticism renders accurately Siddharṣigaṇi's own description - see text quoted below.

[40] NAv 29.20, [12] p. 106 and p. 452: *evaṃ śakanāc chakraḥ, pūr-dāraṇāt purandara ity-ādi bhinnārthatvaṃ sarva-śabdānāṃ darśayati [...] tan naikārtha-vācino dhvanayaḥ santi.*

[41] Cf. [12] p. 105 ff.

[42] Padmarajiah in [13] p. 321 ff. H. S. Bhattacharya in his edition of the *Pramāṇa-naya-tattvālokālaṅkāraḥ* of Vādi Devasūri, Jain Sahitya Vikas Mandal, Bombay, 1967, p. 530 ff. And S. C. Vidhabhusana in his *History of the Mediaeval School of Indian Logic*, Calcutta University, 1907, e.g. p. 12.

[43] S. C. Goshal in his edition and translation of the *Parīkṣāmukham* in *The sacred books of the Jainas* vol. 11, Today and Tomorrow's printers and publishers, Delhi, 1990, p. 202. And N. Tatia in his edition and translation of the *Tattvārtha Sūtra* of Umāsvāti, Lanham, MD: Rowman Altamira, 1994.

> x can be denoted by the speech-element 'x'. Such is [the gist of] the factual[44] [viewpoint][45].

The underlying logic requires a time-place framework that should both accomplish the indexation of definite description, and disallow of substitution of singular terms. This should also hold for indefinite descriptions.

2 A dialogical approach

The aim of this section is to provide the elements of a dialogical reconstruction of the logic of debates underlying each of the viewpoints as discussed in our text. We do not claim that this reconstruction captures all the epistemological features involved in each viewpoint. However, we hope both that the elements of the formal frame developed should provide insights in (the philosophy of) logic at stake and that it motivates further explorations.

More specifically, dialogical logic has a fine-grained theory of meaning that can reflect different levels of meaning changes. This is, in fact the main point of the dialogical approach to pluralism. For short, dialogic distinguishes two levels of meanings and one level where validity is defined. The rock bottom of meaning is represented by what is called the particle-rules that provides the *local meaning* of the logical constants. It is a classical result of dialogic that several different logics such as intuitionistic logic and classical logic share the same local understanding of negation. It is changes at the higher level of the so-called *structural rules* that trigger different kinds of winning strategies. The main point of our formal reconstruction is to implement such fine-grained analysis of changes of meaning while formulating the logic that underlies each viewpoint.

It is important to point out that, as mentioned in the introduction, it might be argued that each type of knowledge has an own sort of predicates that apply to the correspondent object of knowledge. For the sake of simplicity, in this our first formal exploration we will not implement a many-sorted predication. However the dialogical framework has the means to provide an abstract formulation of the use of viewpoint-restricted predicates in a debate. Briefly, the idea is that, during a debate that takes place in a fixed viewpoint, the Opponent is the one who settles the predicates that can be used in assertions. The upshot of this idea is slightly different for the first and second viewpoints than for the other ones, for which there is no quantification on predicates.

2.1 Why dialogical logic?

There are some typical devices a contemporary reader of Indian theses in logic has to pay attention to. We have selected the following ones which motivate the choice of dialogical logic for our reconstruction:

The strong link between meaning and argumentative practices. And the intrinsic link between language and object. Since in the Indian tradition the approach to logic and gnoseology is often cast in a complex nest of arguments and counterarguments, it would be highly desirable to be able to develop the reconstruction of this thought

[44] Recall that Balcerowicz call this viewpoint *factual*.

[45] NAv 29.21, [12], p. 107 and p. 453: *yatra kṣaṇe vyutpatti-nimittam avikalam asti tasminn eva so'rthas tac-chabdena vācya ity evaṃbhūtaḥ*.

in a formal framework in which the meaning and the justifiability of a statement are given by norms governing an argumentative debate . Moreover, a framework where - as mentioned in the discussion of the speech-bound viewpoints - language and object are intrinsically linked is desirable. Dialogical logic meets this condition and thus provides a theory of meaning close to the Jain approach. In dialogical logic, logical constants get their meaning through rules governing their use in a language game, and there are two kinds of rules: the *particle* rules determine the core local meaning of logical constants and the *structural* rules put additional constraints on justifiability of statements where these logical constants occur. In other words meaning and justification conditions are given with respect to ruled argumentative practices: the dialogical theory of meaning is therefore close to the Jain context-sensitive theory.

A pluralist approach. The theory of viewpoints is a pluralist approach insofar as it describes different types of knowledge. Furthermore the *syādvāda* aims at justifying how these different conflicting views can all be defended so far as one pays attention to the contextualisation process. The two kinds of rules in dialogical logic, mentioned above, provide the means of a formal reconstruction of *naya-vāda* that meets the Jain form of pluralism. As a matter of fact the dialogical approach can be used to define different kinds of dialogical games by defining distinct systems of game rules[46], which makes the dialogical approach a pluralist-friendly framework.

In the remaining of this section we introduce the language upon which our dialogical approach is built. We also present successively the particle and structural rules for our dialogical approach. Finally we use those rules to design seven different dialogical systems the differences of which express the differences between the seven viewpoints, and we illustrate our approach with examples.

2.2 The language

Definition 1 (Alphabet) Our language $\mathcal{L}$ is built upon:

- A denumerable set $\mathbf{FO}v$ of first-order variables symbols $x_0, x_1, ...$
- A denumerable set $\mathbf{SO}V$ of monadic second-order variables symbols $X_0, X_1, ...$
- A denumerable set $\mathbf{R}$ of unary predicate symbols (or constants) $P_1, P_2, ...$
- The connectives $\{\wedge, \vee, \rightarrow, \neg\}$
- The quantifiers $\{\forall, \exists\}$
- The ι ($iota$) operator.
- A denumerable set $\mathcal{C}$ of constants: $k_1, k_2, ...$

Definition 2 (Terms) A *term* can be:

a. A first-order variable.
b. A constant from $\mathcal{C}$.
c. An expression of the form $(\iota x)(Px)$ where x is a first-order variable and P is a unary predicate.

Remarks: Let us motivate the choice of such a language. Since there is a viewpoint (the first one) in which two kinds (universals and particulars) of objects are admitted, we need a language in which we can quantify on both and this is precisely the purpose of

[46] see e.g. [8].

introducing second-order quantification. On the other hand, we must not allow higher-order quantification: according to the Indian conception, no universal can inhere in another universal and our language matches this conception insofar as a predicate symbol alone is not a term. In other words, we do not accept second-order predication: expressions of the form PR, where P and R are predicates, are not formulas (see definition 3 below).
We have restricted predicate symbols to the unary case. In fact we assume - but we will not go into details - that assertions with predicates of bigger arity can be read as expressing complex properties of an object. Such an approach is a bit unusual in formal logic, but other traditions of formal reconstruction of natural language, such as DRT, sometimes make this assumption too. The point is that the generalization to predicates of arbitrary arity could blur the parallel with the Indian conception of universals: it is far from obvious, for example, that a binary relation can be thought of as a universal.
Because we use the ι operator as a primitive, a term can be a complex expression of the form $(\iota x)(Px)$. The point of adding such expressions as terms is to give an account of the difference between the first four viewpoints and the last three ones. Such expressions are definite expressions and are to be read as *the x such that...*: in fact they are terms version of quantified assertions of the form *There is a* unique *x such that....* Conversely indefinite descriptions can be understood as existential statements of the form *There is an x such that*, and one can also design term versions of these. Strictly speaking, we should add such terms in our language, as we pointed out when discussing the three speech-bound viewpoints. But we do not treat indefinite descriptions for the sake of simplicity, and because implementing definite description already gives a clear grasp of the specificity of the speech-bound viewpoints compared to the other ones.

Definition 3 (Formulas) Let t, u be terms and $P \in \mathbf{R}$, then $t = u$ and Pt are *atomic formulas*. Complex formulas are given according to the following clauses:

(i) If φ is an atomic formula then φ is a formula.
(ii) If φ, ψ are formulas then $(\varphi \wedge \psi), (\varphi \vee \psi), (\varphi \rightarrow \psi), (\neg\varphi)$ are formulas.
(iii) If φ is a formula and x a first-order variable, then $\forall x\varphi$ and $\exists x\varphi$ are formulas.
(iv) If φ is a formula and X a second-order variable, then $\forall X\varphi$ and $\exists X\varphi$ are formulas.
(v) Nothing else is a formula.

Extending the language. In order to give a *dialogical* approach, we need the following additional devices:

Definition 4 (Labels, forces and scenarios) We start by adding the following to our language:

- Two labels **O** and **P**, standing for the players (respectively Opponent and Proponent). It is useful to introduce the *metavariables* **X** and **Y** (with $\mathbf{X} \neq \mathbf{Y}$) for these labels.
- Two *force* symbols ! and ?

We also use a denumerable list of labels $\mathtt{s}_1, \mathtt{s}_2, \ldots$ standing for *scenarios* (as we introduced them when discussing the viewpoint of ultimate particulars, and which we will also use for the dialogical reconstruction of the such-like viewpoint).

Definition 5 (Moves) By a *move* we mean an expression of the form $\mathbf{X}$-fe such that:

- $\mathbf{X} \in \{\mathbf{O}, \mathbf{P}\}$,
- $f \in \{!, ?\}$[47],
- e is either a formula or taken from $\{R, L, \vee, \exists, k, P\}$ where $k \in Term_1 \cup Term_2$, $P \in \mathbf{R}$ and R, L stand respectively for "Right-hand side" and "Left-hand side" (of a given formula).
  In the case of the dialogical reconstructions of the fourth and seventh viewpoints, moves will be augmented to expressions of the form $\mathbf{X}$-fe-$\mathtt{s}$ where $\mathbf{X}$-fe is as before and $\mathtt{s}$ is a scenario.

2.3 Particle rules

Particle rules give an abstract description of the local meaning of logical constants. It is abstract in the sense that it is completely independent from any particular game situation. Moreover, they are symmetric, that is independent from the identity of the players. The local meaning is given by means of describing how a formula stated by $\mathbf{X}$, given its main logical constant, can be challenged by $\mathbf{Y}$ and defended by $\mathbf{X}$.

Utterance	$\langle \mathbf{X}$ - $\varphi \vee \psi \rangle$	$\langle \mathbf{X}$ - $\varphi \wedge \psi \rangle$	$\langle \mathbf{X}$ - $\varphi \rightarrow \psi \rangle$	$\langle \mathbf{X}$ - $\neg\varphi \rangle$
Challenge	$\langle \mathbf{Y}$ - $?_{\vee} \rangle$	$\langle \mathbf{Y}$ - $?_L \rangle$ or $\langle \mathbf{Y}$ - $?_R \rangle$	$\langle \mathbf{Y}$ - $\varphi \rangle$	$\langle \mathbf{Y}$ - $\varphi \rangle$
Defence	$\langle \mathbf{X}$ - $\varphi \rangle$ or $\langle \mathbf{X}$ - $\psi \rangle$	$\langle \mathbf{X}$ - $\varphi \rangle$ or $\langle \mathbf{X}$ - $\psi \rangle$	$\langle \mathbf{X}$ - $\psi \rangle$	–

Utterance	$\langle \mathbf{X}$ - $\exists x\varphi \rangle$	$\langle \mathbf{X}$ - $\forall x\varphi \rangle$
Challenge	$\langle \mathbf{Y}$ - $?_{\exists} \rangle$	$\langle \mathbf{Y}$ - $?_k \rangle$
Defence	$\langle \mathbf{X}$ - $\varphi[x/k] \rangle$	$\langle \mathbf{X}$ - $\varphi[x/k] \rangle$

Utterance	$\langle \mathbf{X}$ - $\exists X\varphi \rangle$	$\langle \mathbf{X}$ - $\forall X\varphi \rangle$
Challenge	$\langle \mathbf{Y}$ - $?_{\exists} \rangle$	$\langle \mathbf{Y}$ - $?_{P_i} \rangle$
Defence	$\langle \mathbf{X}$ - $\varphi[X/P_i] \rangle$	$\langle \mathbf{X}$ - $\varphi[X/P_i] \rangle$

Where $P_i \in \mathbf{R}$.

There are no particle rules for atomic formulas.

Moves can be utterances, challenges or defences. Utterances always involve formulas, defences too, but challenges not necessarily so.

Definition 6 (Choice) We say that a player makes a *choice* when he performs one move among several moves which are authorized by the same particle rule, except for particle rules for (second-order and first-order) quantification[48].

In the tables above, $\mathbf{X}$ can choose between φ and ψ when defending a disjunction. Conversely, $\mathbf{Y}$ can choose which attack he performs against a conjunction.

2.4 Structural rules

Structural rules determine the general organization of the game by providing the following information:

- Who begins

[47] We often omit to write '!'.

[48] See structural rule $SR2$.

- Which moves are authorized and which are not depending on some game situations.
- How victory and defeat are decided.

The dialogical approach to the theory of viewpoints concerns the second type of rule, by which some moves are authorized or not. In what follows we start by presenting structural rules for standard dialogics. After that we introduce those rules which will be needed in order to apply the dialogical framework to the seven viewpoints.

2.4.1 Usual structural rules

The usual structural rules determine how a game begins, how it is played, in which case it is won or lost by a player, and some restrictions on authorized moves.

SR0 Starting rule. Let Σ be a set of formulas and φ a formula. $\mathcal{D}(\Sigma, \varphi)$, the *dialogue for φ given Σ*, starts by **O** uttering successively the members of Σ after which **P** utters φ, which is called the *thesis* of the game.

The thesis is numbered 0. If relevant, the n utterances by **O** of the n members in Σ are labelled Σ_i, for $1 \leq i \leq n$. **O** and **P** play successively (which means that odd numbers are always associated with **O** moves and that **P** moves are always even). Every move after the thesis is an answer (namely a challenge or a defence) to a previous move, according to the particle rules and allowed by the other structural rules.

SR1 Classical Round Closure rule (SR1c)[49]. Whenever he has a turn to play, **X** can challenge a complex formula previously uttered by **Y** or defend against any previous **Y** challenge, so far that the other rules allow it.

SR2 Repetition rule. After **P** uttered the thesis, **O** and **P** both chose a natural number (resp. `n` and `m`) named their *repetition rank*. Provided the other rules allow it, **O** (resp. **P**) may challenge or defend any single token of an utterance at most `n` (resp. `m`) times.

The proviso that other rules allow such repetitions is important. In particular, the Round Closure rule prevails against the Repetition rule. Consider the Intuitionistic version of the Round Closure: no matter his repetition rank, **P** is not allowed to defend against a **O**-challenge which is not the last non-answered one.

SR3 Formal rule. P is allowed to utter an atomic formula if and only if **O** uttered it beforehand.

SR4 Winning rule. A subdialogue is closed if and only if it contains a **X** utterance of an atomic formula and a **Y** utterance of the same atomic formula. A dialogue is closed if and only if all its subdialogues are closed. A (sub)dialogue is finished iff it is closed or no further move is allowed by the rules. The Proponent wins a (sub)dialogue iff it is closed. The Opponent wins a (sub)dialogue iff it is finished and not closed.

2.4.2 Structural rules and naya-vāda

We interpret the theoretical differences between the viewpoints as variations on structural rules so that we obtain seven dialogical systems, one for each viewpoint. The idea is that the constraints put on players moves must vary from one dialogical system to another, and these variations are due to the different theoretical positions we presented in section 1.

The universal-particular viewpoint. Partisans of the first viewpoint consider that there are two different kinds of objects, namely universals and particulars. Thus, a

[49] There are two versions for the Round Closure rule. The other version is Intuitionistic Round Closure rule:
(SR1i). Whenever he has a turn to play, **X** can challenge a complex formula previously uttered by **Y** or defend against the *last non-answered* **Y** challenge, so far that the other rules allow it.
Dialogical logic was originally developed in relation to Intuitionistic logic. We found no evidence in the texts we studied that one or the other version should be preferred for Jain logic.

statement of the form 'k is P' is understood as dealing with two objects: the particular object k and the property denoted by the predicate P. Now it is the Opponent who settles the appropriate sort of predicates to be used. The upshot for this idea is that the Proponent can use a predicate only if the Opponent *introduced* it beforehand:

SR5 Commitment to Properties Rule. **P** can use a predicate P only if **O** used P previously to challenge a universal (second-order) quantifier or to defend an existential (second-order) quantifier.

This rule makes use of the dialogical approach to quantifiers where, to use the happy formulation of Fontaine, *to be is to be chosen*[50].

The summarizing viewpoint. The dialogical system for the second viewpoint also features Commitment to Properties. However there are two differences between this viewpoint and the first one. First, the summarizing viewpoint considers that only universals are the objects of knowledge: contrary to the first viewpoint, statements do not involve a multiplicity. In other words there is only one sort of quantification. Since the second viewpoint disregards particulars, sentences such as *There is a particular...* are unassertable.

SR6 No First-Order Quantification Rule. No first-order quantification is allowed.

Notice that individual terms remain and can occur in formulas. However, particularity is disregarded at the second viewpoint: objects sharing the same property are indistinguishable. As we mentioned in section 1, this can be expressed by a rule which allows uttering the equality of two terms with respect to a predicate. Here is the precise formulation of this structural rule:

SR-N_2 Summarizing Rule. Whenever **X** uttered Pk_i and Pk_j in the same subdialogue, **Y** can ask **X** to utter $k_i \overset{P}{\approx} k_j$ in this subdialogue.

We use $\overset{P}{\approx}$ for indistinguishableness with respect to property P. As a result, standard substitution is not allowed in the dialogical system for the second viewpoint. More precisely, only the following forms of substitution are available: (i) if $k_1 \overset{P}{\approx} k_2$, then one can substitute k_1 with k_2 in Pk_1 and (ii) one can substitute k_1 with k_2 in any expression only if k_1 and k_2 are indistinguishable for every predicate.

The viewpoint of worldly transactions. As we mentioned in the first section, the reconstruction of the third viewpoint could be seen as a special case of the reconstruction of the fourth one. For the sake of simplicity, we do not delve into the inner structure of intermediate particulars and our reconstruction assumes no other devices than the ones provided by first-order logic. Once again, contrary to the dialogical system for the first viewpoint, only one sort of quantification is allowed. But contrary to the second viewpoint, the viewpoint of worldly transactions regards intermediate particulars, and not universals, as the primary objects of knowledge. Accordingly sentences such as *There is a property...* are unassertable. Thus:

SR7 No Second-Order Quantification Rule. No second-order quantification is allowed.

Since second-order quantification is ruled out, we need to provide another device for the idea that **O** settles the predicates to be used. Starting from this viewpoint, we thus assume that before **P** states the thesis, **O** settles which predicates can be used thanks to a list of initial concessions.

The viewpoint of ultimate particulars. We need a sophisticated framework in which scenarios are taken into account (scenarios can be thought of as time-space points).

[50] See [2].

Before giving further details, let us recall that the viewpoint of ultimate particulars also allows only first-order quantification. In other words, the dialogical system for this viewpoint features $SR7$. Now each scenario has a domain of ultimate particulars. Those are denoted by a new type of terms which are of the form $f_{\mathtt{s_i}}$. Such a term is interpreted as the name of the value of a (partial) function f at scenario $\mathtt{s_i}$[51]. Such functions denote individuals in the usual sense and are sometimes called *individuating functions*. In our terminology they denote intermediate particulars. This system of functions can serve to draw *world-lines* indicating which ultimate particulars in which scenarios pertain to the same intermediate particular. But the fourth viewpoint considers that intermediate particulars are not the object of knowledge. The primary objects of knowledge are the elements of different domains, and they are incomparable. Indeed the use of terms is strictly constrained by scenarios such that two terms $f_{\mathtt{s_i}}$ and $f_{\mathtt{s_j}}$ are substitutable at scenario $\mathtt{s_i}$ if and only if $f_{\mathtt{s_i}} = f_{\mathtt{s_j}}$ at scenario $\mathtt{s_i}$. The following rules cast the world-lines approach to first order logic described above in the dialogical framework:

SR-N_4 Strict Use of Terms Rule. 1. Suppose **X** uttered $f_{\mathtt{s_i}} = f_{\mathtt{s_j}}$ at $\mathtt{s_i}$. Whenever **X** utters at $\mathtt{s_i}$ a formula φ in which $f_{\mathtt{s_i}}$ occurs, **Y** can ask **X** to substitute some occurrences of $f_{\mathtt{s_i}}$ with occurrences of $f_{\mathtt{s_j}}$ at $\mathtt{s_i}$.
2. **P** can choose a term $f_{\mathtt{s_i}}$ at some scenario if and only if:
a. $f_{\mathtt{s_i}}$ is new, or
b. **O** previously chose it at the same scenario.

We also have to pay attention that the usual structural rules must take account of scenarios. For example, the suitable Formal Rule ($SR3$) states that **P** can utter an atomic formula at a scenario $\mathtt{s_i}$ if and only if **O** uttered this formula at $\mathtt{s_i}$ previously. It could be the case that two ultimate particulars are different values of the same function. In such case the individuating function serves to draw a world-line between such two ultimate particulars. We could implement such a device in the dialogical system for the third viewpoint. We would then have to specify that the primary objects of knowledge are denoted by the functions. We would also have to add criteria (for example factual knowledge) granting that world-lines can be drawn between different ultimate particulars. But world-lines and criteria for drawing those are not the primary concern of the fourth viewpoint.

The last three viewpoints pay much more attention to the linguistic characteristics of terms denoting particulars. It is unclear if quantification should be allowed for these viewpoints. Siddharṣigaṇi's text is too brief to take up the issue with the necessary precision. Thus we will restrict the discussion to the use of singular terms: anyway, Siddharṣigaṇi's examples for these viewpoints are based on the use of (proper) names. Our language offers one possibility to give an account for this use by introducing definite descriptions of the form $(\iota x)(Px)$. We should also deal with indefinite descriptions, but we will not treat them for the sake of simplicity.

The viewpoint of synonymy. The framework for the fifth viewpoint assumes that some descriptions convey synonymous meanings, so that different descriptions can name one and the same object. Thus we assume that in addition to the predicates

[51] In fact indexes are determined by the scenario where the function has been chosen. More generally this could happen for any term. The point is that we could have at a scenario the name of an ultimate particular that does not manifest in the scenario at stake. The name of this particular does not name any actual ultimate particular. What to do with utterances involving such terms? Since the underlying philosophy assumes that knowledge is about what is here and now, it looks that the result should be that the player who performs utterances involving them will not be able to respond to a challenge against these utterances. On the other hand, the very point of the fourth viewpoint is that one can have names of actual ultimate particulars without knowing which intermediate particular they constitute. However this is a completely other case and does not prevent occurrence of justified assertions involving such kind of ultimate particulars.

which can be used, **O** also grants a list of synonymies between predicates, where synonymy is denoted by $\sim$. Now we can formulate a form of substitution based on such synonymies:

SR-N_5 Substitution of Synonyms Rule. Suppose $P \sim Q$ has been conceded. In the course of the game, whenever **X** utters a formula in which P occurs, **Y** can demand X to utter the formula resulting from substituting every occurrence of P with Q.

This applies for example to definite descriptions: if $P \sim Q$, $(\iota x)(Px)$ can be substituted with $(\iota x)(Qx)$. If we consider that P stands for *having divine supremacy* and that Q stands for *having the ability to destroy the strongholds*, we obtain Siddharṣigaṇi's own example about *Indra* and *Purandara*. Synonymy between two predicates means that they are dialogically indistinguishable: if one wins/looses in a debate in which P occurs, one can substitute P with Q and the outcome will not change.

The viewpoint of semantic analysis. Contrary to the preceding one, this viewpoint assumes that there is a one-to-one correspondence between descriptions and objects: one name (or description)-one object (there is no synonymy). Accordingly the dialogical framework for this viewpoint disallows substitution between predicates. Thus **O** does not grant synonymy and *SR-N_5* is ruled out:

SR-N_6 One description-one name Rule. Players cannot substitute a predicate with another one.

The such-like viewpoint. Finally, the seventh viewpoint also denies that various names can denote the same object. Moreover, additional constraints are put on the conditions under which an object can be named by a given expression. A name k can be used to designate a particular *at this moment* if and only if k means that there is a (unique) x such that Px and the designated object has this property *at this moment*. Thus the dialogical reconstruction for this viewpoint features temporal scenarios (for the temporal indexation) and the following rule:

SR-N_7 Indexed Designation Rule. 1. Before **P** utters the thesis, **O** concedes a list of identities of the form $k = (\iota x)(Px)$ *without temporal indexation.*
2. Starting from the thesis, moves are labelled with temporal scenarios, and all the usual rules must take those into account.
3. Whenever **X** utters a (possibly complex) formula φ in which k occurs, **Y** can challenge the formula by questioning k ($?_k$). Suppose $k = (\iota x)(Px)$ has been conceded. The proper defence for **Y** is to utter Pk.

It is crucial that the identities conceded by **O** are not indexed by temporal scenarios. It is only at the level of the justification of the use of a name k that the temporal indexes are used. Notice that the second and third parts of the rule literally expresses the double constraint we formulated informally: the two conditions are that k indeed means that *There is an x such that...* and that one can utter k *has the property of...* at a given temporal scenario.

2.5 An example

Given the presentation of the viewpoints in Section 1 and the rules we just designed, we can associate each viewpoint with the following sets of structural rules, in addition to the particle rules:

- The universal-particular viewpoint: $\{SR0, SR1, SR2, SR3, SR4, SR5\}$
- The summarizing viewpoint: $\{SR0, SR1, SR2, SR3, SR4, SR5, SR6, SR\text{-}N_2\}$
- The viewpoint of worldly conventions: $\{SR0, SR1, SR2, SR3, SR4, SR7\}$

– The viewpoint of ultimate particulars: $\{SR0, SR1, SR2, SR3, SR4, SR7, SR\text{-}N_4\}$
– The viewpoint of synonymy: $\{SR0, SR1, SR2, SR3, SR4, SR7, SR\text{-}N_5\}$
– The viewpoint of semantic analysis: $\{SR0, SR1, SR2, SR3, SR4, SR7, SR\text{-}N_6\}$
– The such-like viewpoint: $\{SR0, SR1, SR2, SR3, SR4, SR7, SR\text{-}N_7\}$

Let us give an example of a formula played following two different dialogical systems. Consider the following two dialogues, the first being played with the rules for the second viewpoint (with Summarizing Rule) and the second with rules for the third viewpoint (without Summarizing Rule).

	O			**P**	
	$\mathtt{n} = 1$			$\mathtt{m} = 2$	
				$((Pk_1 \wedge Pk_2) \rightarrow (k_1 \overset{P}{\approx} k_2))$	0
1	$Pk_1 \wedge Pk_2$	0		$k_1 \overset{P}{\approx} k_2$	8
3	Pk_1		1	$?_L$	2
5	Pk_2		1	$?_R$	4
7	$k_1 \overset{P}{\approx} k_2$			$?_{k_1 \overset{P}{\approx} k_2}$	6

Explanations. The numbers in the external columns represent the order in which moves are performed. When a move is a challenge, the number of the move it challenges is indicated in the suitable middle column (for example: move 1 is a challenge against move 0). Players choose their repetition rank $\mathtt{m}$ and $\mathtt{n}$ immediately after **P** utters the thesis. But these ranks play no role in our example. In this dialogue, **P** cannot answer immediately to **O**'s first move: according to the Particle Rule for material implication, he is supposed to utter $k_1 \overset{P}{\approx} k_2$ (the consequent of the thesis). But this is an atomic formula, and the Formal Rule ($SR3$) forbids him to utter it at this moment of the game. Thus he counter-attacks with move 2 and the game proceeds up to move 7. Once **O** herself utters $k_1 \overset{P}{\approx} k_2$, **P** can come back and use it to answer to **O**'s first move. This illustrates that in a dialogue defences are always written in front of the relevant challenges, and keeping track of the order of moves proves useful in such cases. The dialogue is closed: **P** wins.

	O			**P**	
				$((Pk_1 \wedge Pk_2) \rightarrow (x \overset{P}{\approx} y))$	0
	$\mathtt{n} = 1$			$\mathtt{m} = 2$	
1	$Pk_1 \wedge Pk_2$	0			
3	Pk_1		1	$?_L$	2
5	Pk_2		1	$?_R$	4

Explanations. In the second dialogue, the Summarizing Rule ($SR\text{-}N_2$) is not available thus **P** cannot ask **O** to utter $(k_1 \overset{P}{\approx} k_2)$. In other words, he cannot play move 6 of the first dialogue, therefore he is unable to answer **O**'s first move either. The dialogue is finished but not closed: **P** looses.

3 Towards a dialogical framework for Jain logic

So far we presented elements for a dialogical reconstruction of the Jain theory. We pointed out different tasks to achieve in order to refine the reconstruction, e.g. designing a more sophisticated framework for the third viewpoint or implementing indefinite

descriptions. Let us postpone these tasks. The purpose of this section is to describe the next big step towards a unified (dia)logic of disputes.

The Jain project goes beyond the *naya-vāda*. Recall that according to the Jainas, schools associated with viewpoints are defective in the sense that they do not acknowledge that their own perspective is only one among other possible ones. The theory 'of what arguably is' (*syādvāda*) is meant to overcome these defects by providing a theory of disputation in which the different viewpoints can be taken into account. Our next research project is therefore to extend our approach into a unified reconstruction of Jain logic. The *syādvāda* consists in considering predication as conditioned. Thanks to the 'operator' *syāt*, Jain logicians can list seven modes of predication (*saptabhaṅgī*):

- Arguably it is so and so (*syādastyeva*)
- Arguably it is not so and so (*syādnāstyeva*)
- Arguably it is so and so, arguably it is not so and so (*syādastyeva syādnāstyeva*)
- Arguably it is unassertable (*syādavaktavyameva*)
- Arguably it is so and so, arguably it is unassertable (*syādastyeva syādavaktavyameva*)
- Arguably it is not so and so, arguably it is unassertable (*syādnāstyeva syādavaktavyameva*)
- Arguably it is so and so, arguably it is not so and so, arguably it is unassertable (*syādastyeva syādnāstyeva syādavaktavyameva*)

The optative *syāt* is translated as 'arguably', following [3]. We also follow Ganeri in interpreting it as the way to relativize what follows to some viewpoint. As we already stressed out, the Jain theory concerns objects, so in the list above, 'it' refers to some object at stake. We use 'unassertable' for '*avaktavyam*' which literally means 'which is not to be said'. Thus 'it is unassertable' is a shortcut for 'it cannot be said to be so and so nor not to be so and so'. Following [3] we see '*syāt*' as the means by which predication is conditioned: intuitively, we may read it as *There is a viewpoint such that...*. At first sight, '*syāt*' seems to be some kind of possibility operator (in the sense of standard modal logic), and in the semantics proposed by Priest in [15] it is treated this way.

However, such an approach does not seem to match the use of '*syāt*'. For '*syāt*' is not meant to be iterated: as far as we know, the Jain logicians were not interested with statements of the form *There is a viewpoint at which there is a viewpoint at which...*. The reason for this is that each viewpoint attempts to deal with what is the case (here Jainas would add 'according to *this* viewpoint'), not with what could have been the case. In fact the *syāt* operator is rather an existential quantifier on viewpoints which is not embedded in a modal frame structured with a set of possible worlds and accessibility relations. Furthermore, the following points are crucial:
1. A viewpoint is not some unspecified element of a set of possible worlds. Each viewpoint is characterized by a precise underlying logic (and theory of knowledge).
2. The syāt operator does not take just any formula in its scope. The formulae of which it can be predicated that they are *unassertable* or *so and so* etc., are those which are dependent upon the rules that characterize the logic of each viewpoint. Namely:

- Restricted second-order existential generalization (first viewpoint),
- Identity by Summarizing (second viewpoint),
- Substitution of particulars (third viewpoint),
- No Substitution of particulars (fourth viewpoint),

– Substitution of names of particulars by synonymy (fifth viewpoint),
– Disclosing each name with help of a specific definite description which fixes a unique object description (sixth viewpoint),
– Naming unique objects by means of temporally parameterized definite descriptions (seventh viewpoint).

If we follow [3] and interpret '*syāt*' as *There is a viewpoint such that...*, and since we gave dialogical readings of the viewpoints, then the dialogical reading of 'syāt it is so and so' should be: 'there is a dialogical system in which it is so and so'. Or stated otherwise: there are game rules such that 'it is so and so' can be won. Let us write 'syāt φ' with $\mathcal{S}\varphi$. The dialogical operator $\mathcal{S}$ should not be read as a usual alethic possibility, and thus should not be challenged as usual[52] by asking for a context, but by asking for the rules to use in order to play a dialogue for φ. That is, $\mathcal{S}$ is not meant to have a local meaning but a structural influence, by fixing the rules the game must be played with. The rule for an expression of the form $\mathcal{S}\varphi$ is a structural rule of the following form:

SR-syāt. A **X** expression of the form $\mathcal{S}\varphi$ is challenged by **Y** asking **X** which rules must be used to play a dialogue for φ. Once **X** has chosen the rules, **Y** asks **X** to utter φ.

Now the crucial point is that, given combinations of expressions of the form $\mathcal{S}\varphi$, the rules can change during a dialogue. Take the third predication mode *Arguably it is so and so, arguably it is not so and so*. The dialogue will start with **P** uttering a conjunction of expressions containing $\mathcal{S}$, so (by the rules for $\wedge$ and $\mathcal{S}$) he will have to choose rules two times, and nothing forces him to choose the same rules each time. In fact, it is strategically better for him to change rules, in order to avoid contradiction. Let us give an obvious example. Suppose the dialogue starts by **P** uttering an expression of the form $\mathcal{S}\varphi$, where φ contains second-order quantification. **O** starts by challenging $\mathcal{S}$, that is by asking **P** to choose a dialogical system for the game. Let us consider the case where **P** choose any system except the one for the first and second viewpoints, say the system for the third viewpoint. **O** then asks **P** to utter φ, but **P** cannot because of rule $SR7$: **P** looses. Had he chosen the system for the first viewpoint, he could have at least uttered φ.

The preceding remarks suggest that the unified dialogical approach for Jain logic would implement an additional strategical dimension: the choice of rules when defending a $\mathcal{S}$ operator. Such a dialogical system seems adequate because it can be used to implement confrontation between different viewpoints.

4 Conclusion

The dialogical framework is, in our view, a promising approach for a contemporary reconstruction of the Jain contribution to logic. The main reasons for this are linked to:

1. The notion of meaning at stake. Indeed the dialogical framework allows a reconstruction of the underlying logic in which a strong connection between meaning and argumentation furnishes a suitable approach to the interaction between word and object.
2. An epistemological claim. The dialogical approach, able to distinguish changes of meaning at different levels, seems to offer a natural framework for the formulation of Jain epistemology.

[52] More on usual modal dialogics can be found in [8].

In fact, we proposed a reconstruction of the seven viewpoints of the *naya-vāda* by means of seven dialogical systems, each with its own set of structural rules - i.e. rules that determine global meaning. A set of game rules determine which strategies are available for a player. Thus each viewpoint can be characterized by a type of available strategies. In this sense our reconstruction replaces argumentative practices and strategies at the heart of a contemporary reading of Jain logic. More generally, according to our view, our approach seems to offer a fine-grained account for the logical contextualisation process at stake in the Jain theory.

The next step will be to extend the reconstruction in order to implement the *syādvāda*. Ultimately our aim is to provide a unified reconstruction of the (dial)logic of disputes in Jain epistemology and logic.

Acknowledgements We are particularly grateful to an anonymous reviewer for his thorough and helpful remarks and insights which led to many improvements. We wish to thank Laurent Keiff for discussions. We are also thankful to the participants in the workshop 'Modern Formalisms for Pre-Modern Indian Logic and Epistemology' (Hamburg, June 2010) for fruitful discussions. The workshop took place in the context of the research project "Dynamic and Dialogical Approaches to Historical Logic" (DDAHL).

References

[1] M. Fontaine, M.H. Gorisse and S. Rahman. 'Dynamique Dialogique: Lecture d'une controverse entre logiciens jaïns et grammairiens en Inde classique'. Forthcoming.

[2] M. Fontaine, J. Redmond and S. Rahman. 'Etre et être choisi. Vers une Dynamique de la Logique de la Fiction'. To appear in J. Dubucs and B. Hill (eds.) *Fiction : Logiques, Langages, Mondes*, London: College Publications.

[3] J. Ganeri. 'Jaina Logic and the Philosophical Basis of Pluralism'. In *History and Philosophy of Logic*, vol.23, n.4, Taylor and Francis Ltd: York, 2002, pp.267–281.

[4] J. Ganeri. 'Indian Logic'. In D. M Gabbay and J. Woods (eds.), *Handbook of the History of Logic. Vol.1: Greek, Indian and Arabic Logic*, Elsevier: Amsterdam, 2004, pp. 309–395.

[5] MH. Gorisse. 'The art of non-asserting: dialogue with Nāgārjuna'. Proceedings of the third colloquium 'Indian Conference on Logic and its Applications', in R. Ramanujam and S. Sarukkai (eds.) *Springer Lecture Notes in Artificial Intelligence*, Vol.5378, FoLLi series, Springer, 2009, pp. 257-268.

[6] J. Hintikka. 'Semantics for Propositional Attitudes'. In J.W. Davis and alia (eds.), *Philosophical Logic*, Dordrecht: Reidel, 1969, pp. 21–45.

[7] L. Humberstone. 'Modal formulas true at some point in every model'. In *The Australian journal of logic*, vol.6, 2008, pp. 70–82.

[8] L. Keiff. 'Dialogical Logic'. Entry of Stanford Encyclopedia of Philosophy. http://plato.stanford.edu/entries/logic-Dialogical/

[9] K. Lorenz. 'Features of Indian Logic'. In *Dialogues, Logics and Other Strange Things. Essays in Honour of Shahid Rahman*, College Publication, London, 2008, pp. 263–275.

[10] B. K. Matilal. *The central philosophy of Jainism*. Edited by D. Malvania and N. J. Shah, L.D. Series n.79, L.D. Institute of Indology: Ahmadabad, 1981.

[11] B. K. Matilal. *The Character of logic in India*. Edited by J. Ganeri and H. Tiwari, Owford University Press: Delhi, 1998.

[12] Siddhasena Divākara. 'Nyāyāvatāra'. In P. Balcerowicz (ed. and tr.), *Jaina epistemology in historical and comparative perspective*, Franz Steiner Verlag: Stuttgart, 2001 (Sanskrit and English).

[13] Y. J. Padmarajiah. *A comparative study of the Jaina theories of Reality and Knowledge*. Motilal Banarsidass: Delhi, 1963.

[14] Prabhācandra. 'Prameyakamalamārtaṇḍa'. In M. K. Shastri (ed.), *Sri Garib Dass Oriental Series* n.90, Sri Satguru Publication: Delhi, 1990 (first ed. 1912)(Sanskrit).

[15] G. Priest. 'Jaina Logic: A contemporary Perspective'. In *History and Philosophy of Logic* 29 no. 3, 2008, pp. 263-278.

[16] S. Rahman, N. Clerbout and L. Keiff. 'On Dialogues and Natural Deduction'. In G. Primiero and S. Rahman (eds.), *Acts of Knowledge: History, Philosophy and Logic*, 2009, pp. 301–336.

[17] S. Rahman and L. Keiff. 'On How to be a Dialogician'. In D. Vanderveken (ed.), *Logic, Thought and Action*. New York: Springer, 2005, pp. 359–408.

[18] S. Rahman and T. Tulenheimo. 'From Games to Dialogues and Back: Towards a General Frame for Validity'. In O. Majer, A.-V. Pietarinen and T. Tulenheimo (eds.), *Logic and Games: A Foundational Perspective*, Kluwer-Springer, 2006, pp. 153–208.